University of California, Berkeley
Physics 110B Fall 2004 (*Strovink*)

EXAMINATION 2

Directions: Do both problems, which have equal weight. This is a closed-book closed-note exam except for Griffiths, Pedrotti, a copy of anything posted on the course web site, and anything in your own handwriting (not a Xerox of someone else's writing). Calculators are not needed, but you may use one if you wish. Laptops and palmtops should be turned off. Use a bluebook. Do not use scratch paper – otherwise you risk losing part credit. Show all your work. Cross out rather than erase any work that you wish the grader to ignore. Justify what you do. Express your answer in terms of the quantities specified in the problem. Box or circle your answer.

Problem 1. (50 points)
In a spatial region there exist uniform static crossed electric and magnetic fields

$$\vec{E} = \hat{x}\, E_0$$
$$c\vec{B} = \hat{y}\, \tfrac{1}{2} E_0 \ .$$

At time $t = 0$, a particle having charge q and rest mass m has velocity $c\vec{\beta}(0)$, where

$$\vec{\beta}(0) = \tfrac{1}{2}\, \hat{z} \ .$$

At time $t_1 > 0$, calculate the ratio

$$R = \frac{p_z(t = t_1)}{p_z(t = 0)} \ ,$$

where p_z is the $\hat{z}$ component of the particle's momentum.

[*Hint: Consider the fields in the inertial frame that is at rest with respect to the particle at* $t = 0$.]

Problem 2. (50 points)
A point particle having charge q moves with uniform speed βc in a circle of radius b in the xy ($z = 0$) plane. At time $t = 0$ the particle is located at

$$\{x, y, z\}(t = 0) = \{b \cos\beta, b \sin\beta, 0\} \ .$$

(Yes, that's the same β.)

Making no approximations, calculate the electric field $\vec{E}$ produced by the particle as seen at time $t = 0$ by an observer at the origin.

[*Hint: Where was the particle when it created the field seen by the observer at* $t = 0$*?*]